APPENDIX 3

AIR QUALITY REGULATIONS

The basic framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act and its amendments, and the 1999 Regional Haze Regulations. The Clean Air Act addresses criteria air pollutants, State and national ambient air quality standards for criteria air pollutants, and the Prevention of Significant Deterioration program. The Regional Haze Regulations address visibility impairment.

POLLUTANTS

Air Pollutants addressed in this study include criteria pollutants, hazardous air pollutants (HAP) and sulfur and nitrogen compounds.

Criteria Pollutants

Criteria pollutants are those for which national standards of concentration have been established. Pollutant concentrations greater than these standards represent a risk to human health. Criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), particulate matter (PM_{10}, $PM_{2.5}$), and lead (Pb).

CO is an odorless, colorless gas formed during any combustion process, such as operation of engines, fireplaces, furnaces, etc. High concentrations of CO affect the oxygen-carrying capacity of the blood and can lead to unconsciousness and asphyxiation. Forest fires are a natural source of CO.

NO_2 is a red-brown gas formed during the operation of internal combustion engines. Such engines emit a mixture of nitrogen gases, collectively called nitrogen oxides (NO_x). NO_2 can contribute to brown cloud conditions, and can convert to ammonium and nitrate particles and nitric acid, which can cause visibility impairment and acid rain. Bacterial action in soil can be a natural source of nitrogen compounds.

O_3 is a faintly blue gas that is generally not emitted directly into the atmosphere, but is formed from NO_x and volatile organic compound (VOC) emissions. As stated above, internal combustion engines are the main source of NO_x. Volatile organic compounds like terpenes are very reactive. Sources of VOC include paint, varnish and some types of vegetation. The faint acrid smell common after thunderstorms is due to ozone formation by lightning. O_3 is a strong oxidizing chemical that can burn lungs and eyes, and damage plants.

SO_2 forms during combustion from trace levels of sulfur in coal or diesel fuel, and can convert to ammonium sulfate (SO_4^-) and sulfuric acid (H_2SO_4), which can cause visibility impairment and acid rain. Volcanoes are a natural source of SO_2.

Particulate matter (i.e., soil particles, hair, pollen, etc.) is essentially the small particles suspended in the air, which settle to the ground slowly and may be re-suspended if disturbed. Separate allowable concentration levels for particulate matter are based on the relative size of the particle:

> PM_{10}, particles with diameters less than 10 micrometers, are small enough to be inhaled and can cause adverse health effects.

$PM_{2.5}$, particles with diameters less than 2.5 micrometers, are so small that they can be drawn deeply into the lungs and cause serious health problems. These particles are also the main cause of visibility impairment.

Hazardous Air Pollutants

There are a wide variety of hazardous air pollutants including N-hexane, ethylbenzene, toluene, xylene, formaldehyde and benzene. Although hazardous air pollutants do not have federal standards, they do have "significance thresholds" set by various States and are typically evaluated for potential chronic inhalation and cancer risks.

Hazardous air pollutant emissions are associated with industrial activity, including oil and gas operations, refineries, paint facilities, wood working shops and dry cleaners.

Sulfur and Nitrogen Compounds

Sulur and nitrogen compounds that can be deposited on terrestrial and aquatic ecosystems include nitric acid (HNO_3), nitrate (NO_3), ammonium (NH_4), and sulfate (SO_4).

Nitric acid (HNO_3) and nitrate (NO_3) are not emitted directly into the air, but form in the atmosphere from industrial and automotive emissions of nitrogen oxides (NO_x). Sulfate (SO_4) is formed in the atmosphere from industrial emission of sulfur dioxide (SO_2). Deposition of HNO_3, NO_3 and SO_4 can adversely affect plant growth, soil chemistry, lichens, and petroglyphs.

Ammonium (NH_4) is associated with feedlots and agricultural fertilization. Deposition of NH_4 can affect vegetation. While deposition may be beneficial as a fertilizer, it can adversely affect the timing of plant growth and dormancy.

WYOMING AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) set the absolute upper limits for criteria air pollutant concentrations at all locations to which the public has access. The WAAQS and NAAQS are legally enforceable standards. Concentrations above the WAAQS and NAAQS represent a risk to human health. State standards must be equally or more strict than federal standards.

The EPA has developed standards for each criteria pollutant for a specific averaging time. Short averaging times (1, 3, and 24 hours) address short-term exposure, while the annual standards address long-term exposure. Annual standards are set to lower allowable concentrations than are short-term standards to recognize the cumulative effects of long-term exposure.

TABLE 1
NATIONAL AND WYOMING AIR QUALITY STANDARDS
FOR CRITERIA POLLUTANTS

Pollutant	Averaging Time	NAAQS (mg/m^3)	WAAQS (mg/m^3)
Carbon monoxide (CO)	1 hour	40,000	40,000
	8 hour	10,000	10,000
Nitrogen dioxide (NO_2)	Annual	100	100
Sulfur dioxide (SO_2)	3 hour	1300	695
	24 hour	365	260
	Annual	80	60
Ozone (O_3)	1 hour	235	
	8 hour	157	157
Particulate matter (PM_{10})	24 hour	150	150
	Annual	50	50
Fine particulate matter ($PM_{2.5}$)	24 hour	65	
	Annual	15	

PREVENTION OF SIGNIFICANT DETERIORATION

The goal of the Prevention of Significant Deterioration (PSD) program is to ensure that air quality in areas with clean air does not significantly deteriorate, while maintaining a margin for future industrial growth. Under PSD, each area in the United States is classified by the air quality in that region:

- PSD Class I Areas: Areas with pristine air quality, such as wilderness areas, national parks and Indian reservations, are accorded the strictest protection. Only very small incremental increases in concentration are allowed in order to maintain the very clean air quality in these areas.
- PSD Class II Areas: Essentially, all areas that are not designated Class I are designated Class II. Moderate incremental increases in concentration are allowed, although the concentrations are not allowed to reach the concentrations set by Wyoming and federal standards (WAAQS and NAAQS).
- PSD Class III Areas: No areas have yet been designated Class III. Concentrations would be allowed to increase all the way up to the WAAQS and NAAQS.

TABLE 2
PSD INCREMENTS

Pollutant	Averaging Time	PSD Increment (mg/m^3)	
		Class I	Class II
Nitrogen dioxide (NO_2)	Annual	2.5	25
Sulphur dioxide (SO_2)	3 hour	25	512
	24 hour	5	91
	Annual	2	20
Particulate matter (PM_{10})	24 hour	8	30
	Annual	4	17

PSD Class I areas in the Snake River region include the Bridger, Fitzpatrick and Washakie Wilderness Areas and Grand Teton and Yellowstone National Parks. Special status Class II areas include the Popo Agie Wilderness Area and the Wind River Roadless Area. The Snake River project area is also classified as PSD Class II.

Comparisons of potential NO_2 and SO_2 concentrations with PSD increments are intended only to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption analysis. Consumption analyses are applied to large industrial sources and are solely the responsibility of the State and the Environmental Protection Agency.

REGIONAL HAZE REGULATIONS

Visibility impairment is an indicator of air pollution concentration. Visibility can be defined as the furthest distance at which one can perceive color, contrast and detail. Fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Visual range, one of several ways to express visibility, is the furthest distance a person can distinguish a dark landscape feature from a light background like the sky. Without human-caused visibility impairment, natural visual range would average about 150 miles in the western United States and about 70 miles in the eastern United States.

The Regional Haze Regulations were developed by the EPA in response to the Clean Air Act Amendments of 1990. They are intended to maintain and improve visibility in PSD Class I areas across the United States, so that visibility in these areas is returned to natural conditions. These regulations require States to demonstrate reasonable progress in maintaining or improving visibility in PSD Class I areas.